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53
ORIGINAL

AMBIENT AIR QUALITY MONITORING PLAN

SHAWNEE STEAM PLANT

AIR RESOURCES PROGRAM

TVA/ONR/ARP-81/16

TENNESSEE VALLEY AUTHORITY

Office of Natural Resources

Air Resources Program

AMBIENT AIR QUALITY MONITORING PLAN

SHAWNEE STEAM PLANT

Prepared by

Auburn E. Owen, Jr.

and

Roy V. Carter

Muscle Shoals, Alabama

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CONTENTS

	Page
Introduction	1
Background Information	3
Approach	9
Objectives for Air Quality Monitoring	11
Methods	13
Modeling	13
Ranking Site Effectiveness	13
Discussion of Results	15
Modeling	15
Ranking of Effectiveness	15
Proposed Network	23
Appendix A - Kentucky Air Pollution Control Regulations and Letters from EPA Approving TVA SO_2 and TSP Monitoring Methods	27
Appendix B - Air Pollution Rose Data - Shawnee Steam Plant - 1975-1979	37

TABLES

		Page
1.	SO_2 Monitoring Data - Shawnee Steam Plant December 6, 1977 to May 15, 1978.	18
2.	Ranking of the Effectiveness of Ambient Air Quality Monitoring Stations in the Vicinity of the Shawnee Steam Plant	19
3.	Monitoring Objectives Achieved by the Proposed Network. . .	25

FIGURES

1.	Plant Operating Level - Shawnee Steam Plant 1975-1979 . . .	4
2.	SO_2 Emissions - Shawnee Steam Plant 1975-1979	4
3.	Existing Ambient Air Quality Monitoring Network at the Shawnee Steam Plant	5
4.	Maximum and Second Highest 3- and 24-Hour Average SO_2 Concentrations Measured at Stations in the Shawnee Steam Plant Monitoring Network 1975-1979.	6
5.	Areas of SO_2 Affected Vegetation in the Vicinity of Shawnee Steam Plant	7
6.	Modeled Maximum 3- and 24-Hour SO_2 Concentration Impact Points in the Vicinity of the Shawnee Steam Plant	16
7.	The Percentage of Time Existing Monitors Were Downwind of the Shawnee Steam Plant	17
8.	Air Pollution Roses - 244-meter Stack Operation - December 6, 1977 - May 15, 1978 - Shawnee Steam Plant.	20
9.	Location of Stations in the Proposed Ambient Air Quality Monitoring Network at the Shawnee Steam Plant	24

Ambient Air Quality Monitoring Plan

Shawnee Steam Plant

Introduction

TVA has conducted ambient air quality monitoring in the vicinity of Shawnee Steam Plant since 1953. The purposes for monitoring were to collect background information prior to the time the plant reached full operating loads in 1956 and for documenting ambient air quality levels thereafter.

In 1976, TVA sought to bring the Shawnee Steam Plant into compliance with provisions of the Clean Air Act by meeting applicable National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2). TVA selected the alternative (then available under Kentucky law) of meeting ambient rather than emission standards as the most practical means of achieving compliance, since the technology for applying SO_2 emission control equipment to large power plants had not been sufficiently developed.

To ensure that the steam plant met ambient standards, TVA implemented its Sulfur Dioxide Emission Limitation (SDEL) Program. This program provided for the control of plant emissions through the intermittent reduction of power generation under meteorological conditions conducive to high ambient SO_2 levels and exceedance of standards. Data from the SO_2 monitors were used to verify that ambient standards were not exceeded and to upgrade SDEL program effectiveness.

The SDEL program operated continuously at Shawnee since its implementation in 1976. It was integrated into the Consent Decree interim plan in 1978 for the purpose of controlling SO_2 and particulate emissions until the plant met required emission standards. The consent decree stipulated that the plant should attain compliance with SO_2 emission standards by October 1981 and particulate standards by November 1981.

A number of improvements are being made in plant operations to meet air quality emission standards. These include the use of low-sulfur coal to meet the required 1.2 $lb/10^6$ Btu SO_2 emission standard and the installation of baghouses to comply with the 0.11 $lb/10^6$ Btu particulate standard. Future plans also include use of two new 244-meter (m) stacks.

There are Kentucky regulations that require TVA to conduct ambient air quality monitoring at Shawnee Steam Plant. Kentucky Division of Air Pollution Regulations (dated June 1979) empower that agency to direct source owners to perform ambient air quality monitoring. These regulations (kAR 50:050, Monitoring, Section 1.) state that "the department may require the owner or operator of any affected facility to install, use, and maintain stack gas and ambient monitoring equipment in accordance with such methods as the department may prescribe." They also state that "persons owning or operating an affected facility for which a standard is prescribed in the regulations of the Division

of Air Pollution, when required by the department, shall install, use and maintain ambient monitoring equipment in accordance with the provisions of 401 KAR 53:010, Section 2, and shall make periodic reports at intervals prescribed by the department." 401 KAR 53:010, Section 2, requires that measurements of SO_2 and total suspended particulate (TSP) be made with reference or equivalent methods. Appendix A contains these specific Kentucky regulations, and letters from EPA which approve TVA's methodology for measuring ambient SO_2 and TSP. Since TVA has voluntarily complied with the purpose and intent of these regulations, the State agency has not considered it necessary to officially request TVA to conduct ambient monitoring.

The purpose of this monitoring plan is to present a new network design for an Shawnee Steam Plant.[1]

---

1. All TSP monitors will be collocated with SO_2 monitors to document ambient TSP levels that are attributable to steam plant stack emissions.

Background Information

To determine the current status of air quality conditions at Shawnee Steam Plant, a review was made of plant operating levels, SO_2 emission data, ambient air quality data, and other related information for the period 1975-1979.

The Shawnee Steam Plant is a steam electric generating facility consisting of 10 pulverized coal-fired 175-megawatt (MW) units each served by a 76-m stack. Each of the generating units is equipped with electrostatic precipitators and baghouses (under construction) for reducing particulate emissions.

Monthly average electrical generation rates at Shawnee for the years 1975-1979 are presented in figure 1. During this period the plant generated between 500 and 1000 MW (monthly average). Monthly average SO_2 emissions from Shawnee for the years 1975-1979 are shown in figure 2. The maximum and second highest 3- and 24-hour SO_2 concentrations measured at monitoring stations in the vicinity of Shawnee Steam Plant (figure 3), 1975-1979, are shown in figure 4.

Botanical surveys were conducted during the 1975 through 1979 growing seasons (May-September), to determine if SO_2 emissions from Shawnee Steam Plant had visibly affected vegetation. Areas where SO_2 effects were observed on sensitive vegetation during each of the five years are shown in figure 5.[2]

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2. Survey reports are available upon request.

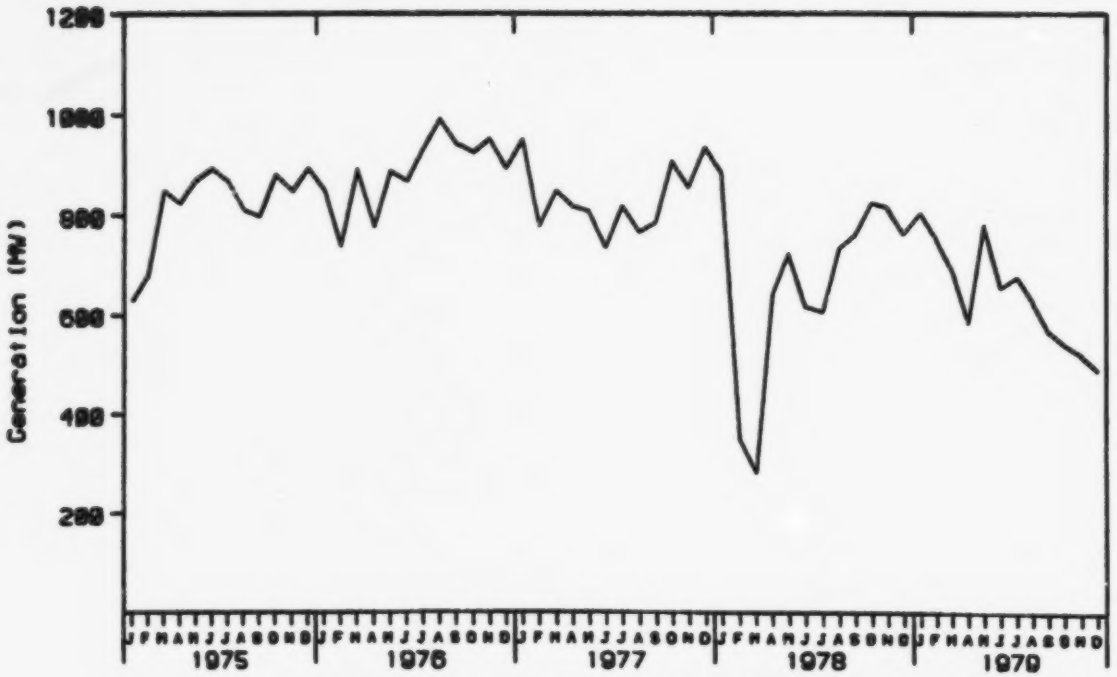
Generation (MW)
1200
1000
800
600
400
200
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1975
1976
1977
1978
1979

Figure 1. PLANT OPERATING LEVEL - SHAWNEE STEAM PLANT 1975-1979

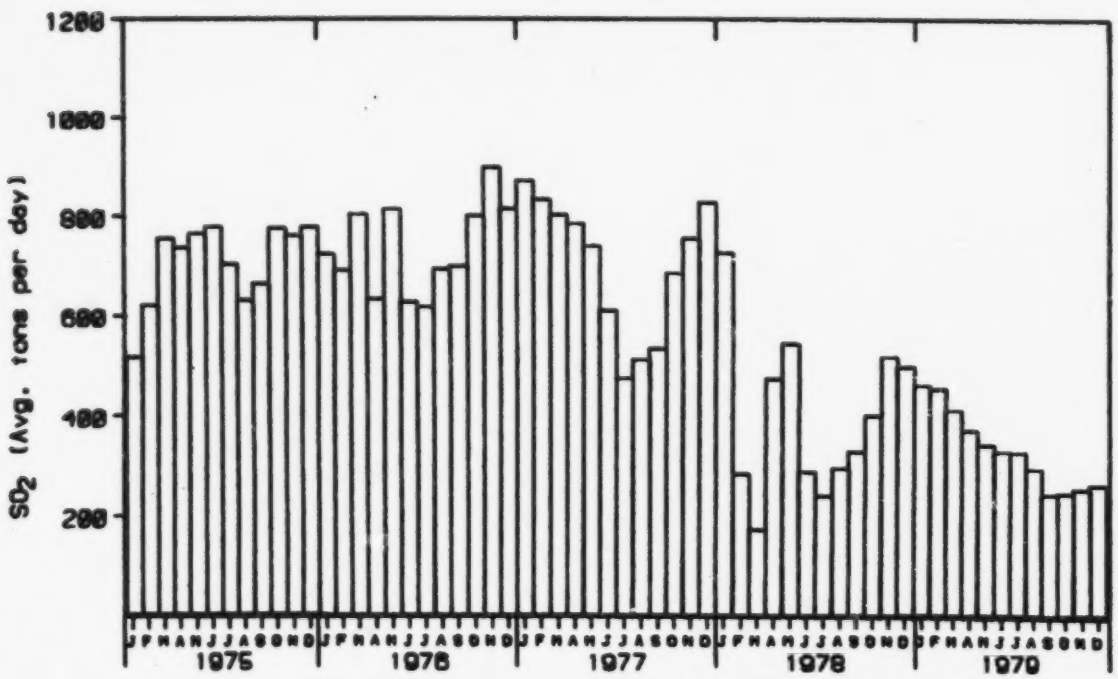
SO_2 (Avg. tons per day)
1200
1000
800
600
400
200
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1975
1976
1977
1978
1979

Figure 2. SO_2 EMISSIONS - SHAWNEE STEAM PLANT 1975-1979

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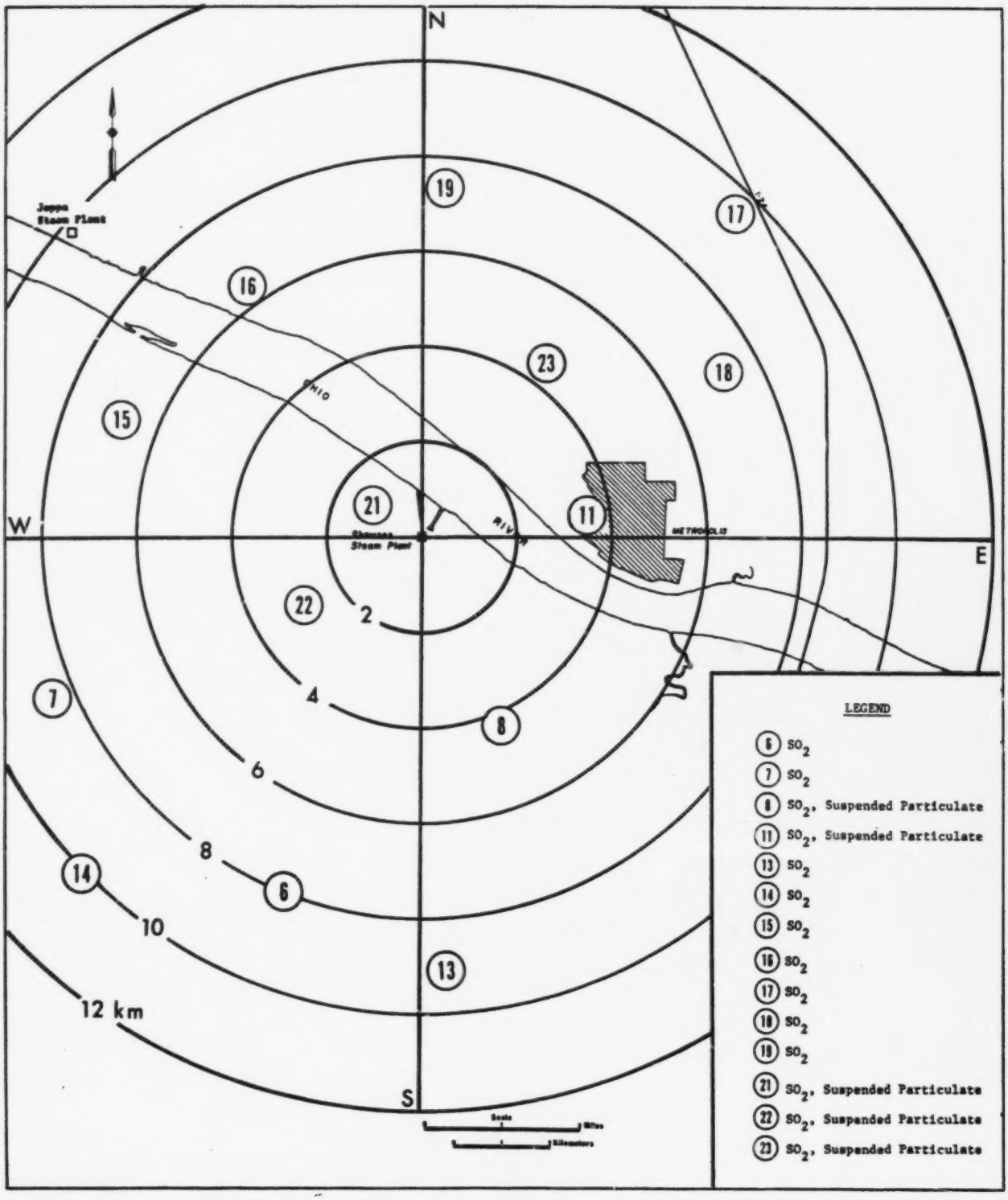

Figure 3. EXISTING AMBIENT AIR QUALITY MONITORING NETWORK AT THE SHAWNEE STEAM PLANT

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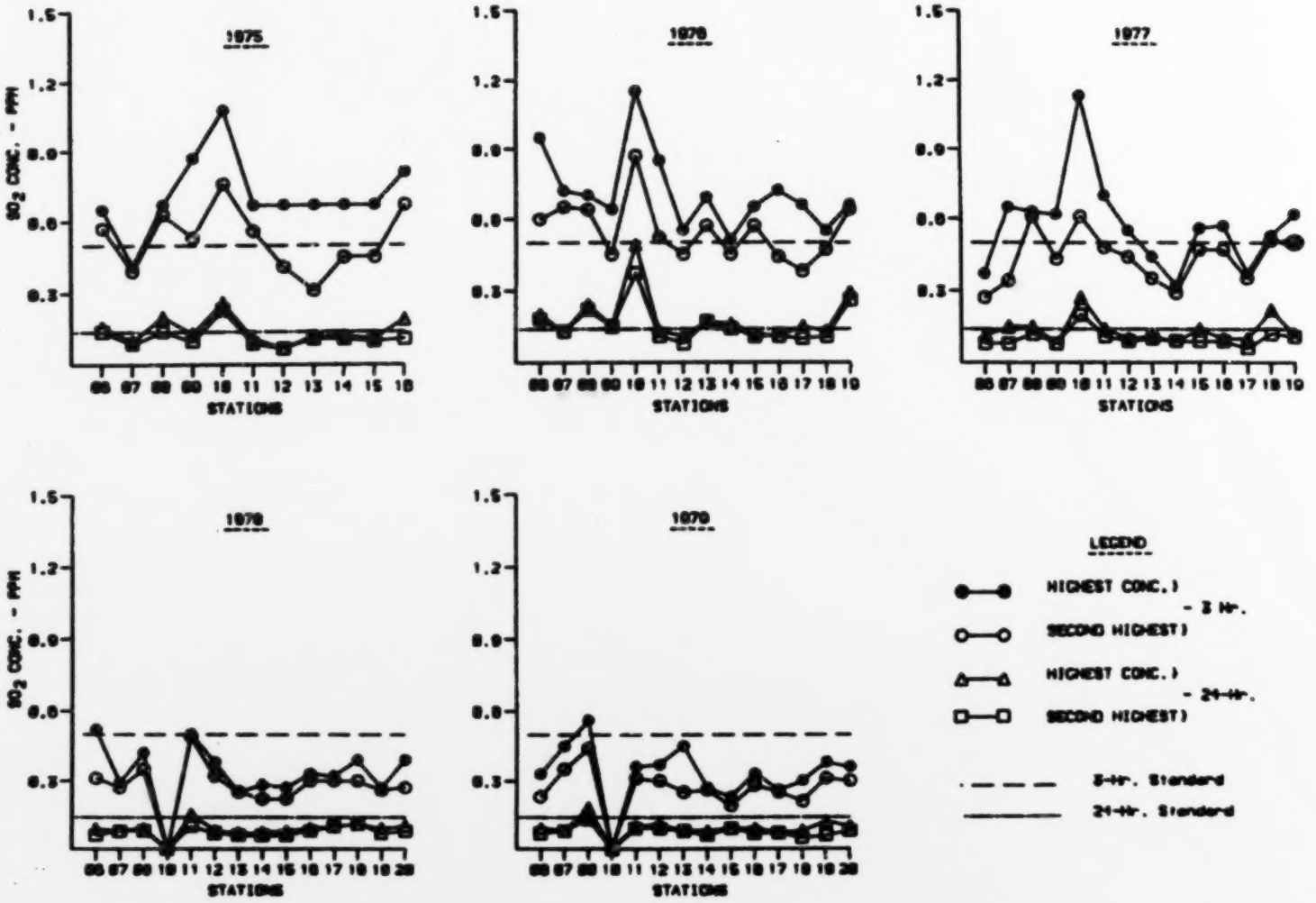

Figure 4. MAXIMUM AND SECOND HIGHEST 3- AND 24-HOUR AVERAGE SO_2 CONCENTRATIONS MEASURED AT STATIONS IN THE SHAWNEE STEAM PLANT MONITORING NETWORK 1975-1979

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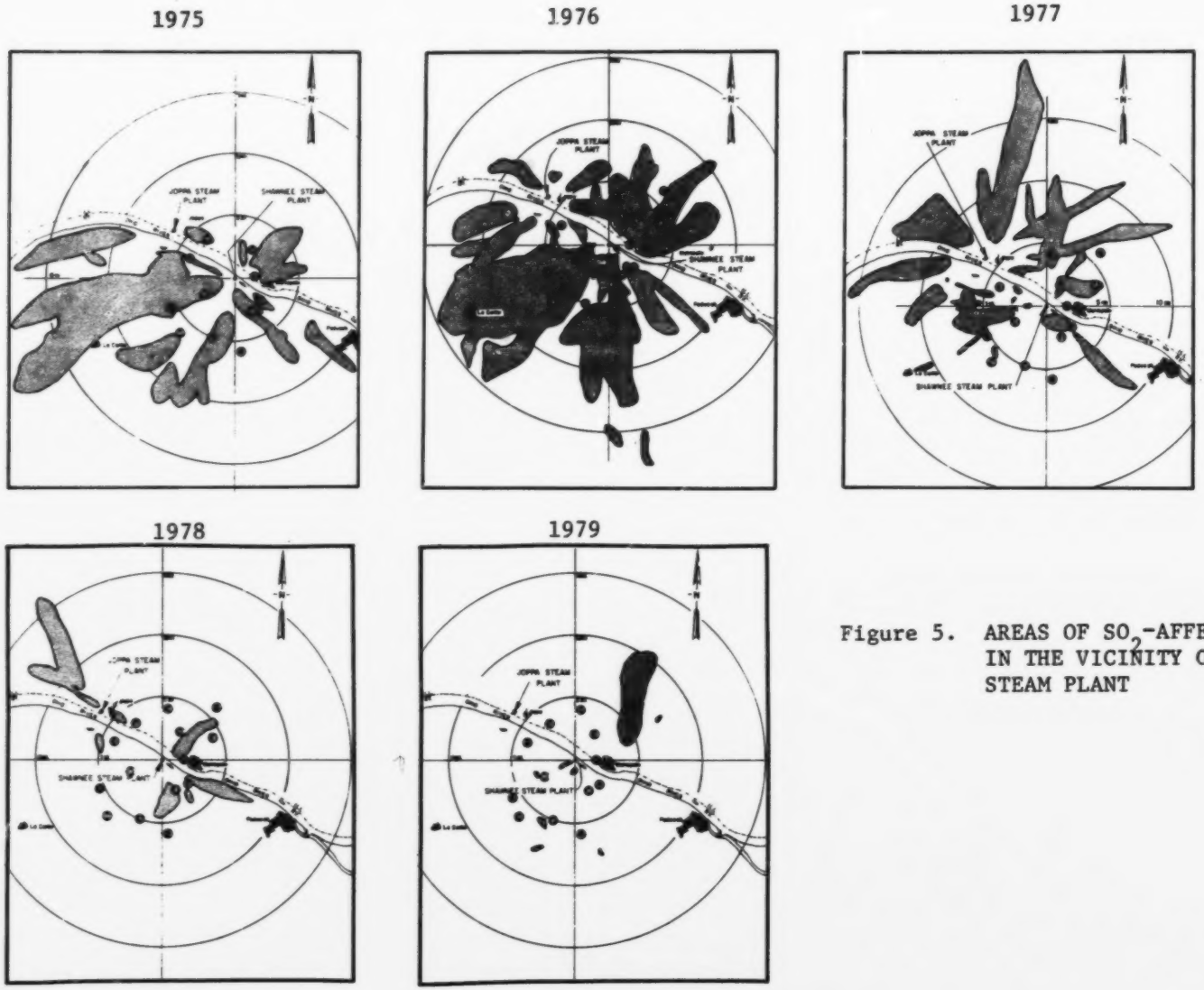

Figure 5. AREAS OF SO_2-AFFECTED VEGETATION IN THE VICINITY OF SHAWNEE STEAM PLANT

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Approach

The development of a network design for Shawnee Steam Plant involved the following steps:

1. Objectives were evaluated and defined in terms of present and future needs and requirements.

2. A modeling analysis was performed to identify sites where highest SO_2 concentrations may be expected to occur relatively frequently under various atmospheric conditions.

3. All pertinent air quality, meteorological, plant operating, and botanical effects data were evaluated to determine which existing monitoring stations were most effective in documenting ambient levels.

4. An evaluation was made of the information from steps 1 through 3; judgments were made about which sites would best satisfy monitoring objectives.

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Objectives for Air Quality Monitoring

TVA conducts ambient air quality monitoring in the vicinity of Shawnee to determine the impact of its gaseous and particulate emissions and to determine compliance with standards. The primary and secondary objectives are as follows:

A. Primary Objectives

1. Monitor in areas expected to receive high 3- and 24-hour SO_2 concentrations with significant frequency.

2. Monitor in areas expected to receive high 24-hour TSP concentrations.

TVA also conducts its monitoring to meet the following additional, although less constraining, objectives when possible to more adequately characterize air quality conditions.

B. Secondary Objectives

1. Monitor in the areas of combined impact from the TVA plant and other major air pollution sources.

2. Monitor to obtain overall area coverage of pollutant levels.

3. Preferentially monitor in populated areas over nonpopulated areas.

In selecting monitor site locations, primary objectives were met, and secondary objectives were met when practical.

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Methods

Modeling

Projections of ground-level SO_2 concentrations from the new Shawnee Steam Plant tall stacks were made using a modified version of EPA's CRSTER model. To ensure that monitors would be properly located to measure high concentrations, candidate areas were identified for several critical dispersion conditions. In order to obtain the required modeling results, the CRSTER program was modified to calculate concentrations for only those 3-hour periods which met one of the following three conditions: (1) two hours of stability class "A", (2) three hours of "B" or two hours of "B" and one hour of "C", or (3) three hours or "C" and/or "D". Highest SO_2 concentrations under stable conditions ("E," "F," and "G" stability) occur well beyond 15 kilometers (km) from the steam plant and can be expected to be an order of magnitude or more below the highest modeled concentrations for unstable conditions. Consequently, separate CRSTER runs were not made for the stable stability classes. The projections of 24-hour coverage concentrations were not subject to the above screening procedure.

In identifying candidate areas based on model results, special consideration was given to both the magnitude of and the expected frequency of occurrence associated with the modeled concentrations. The analysis for the 3-hour-averaging period, consequently, was based on the "top-50" CRSTER summary table. This was done in order to make the identification of potential monitoring locations dependent upon less extreme (use of maximum and second highest results was avoided), but more probable modeling results.

The meteorological data used in the modeling consisted of one year (1964) of hourly surface data for Paducah, Kentucky, and concurrent mixing height data for Nashville, Tennessee. Source data used were from the new 244-m stacks. The plant was modeled at the worst-case 100 percent load condition.[3]

Ranking Site Effectiveness

An evaluation scheme was developed to rank existing air monitoring stations with regard to their effectiveness in meeting the primary monitoring objectives. Only data for the period December 6, 1977, through May 15, 1978 (when the plant operated on the 244-m stacks) were used in the ranking scheme. To determine ranking values, individual factors were assigned various weights (depending on their importance) which were used to calculate numerical values for each station. Weighted values were subsequently totaled and stations were ranked according to their numerical value.

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3. A more extensive discussion of the modeling analysis for Shawnee Steam Plant is presented in a separate Air Resources Program report, which is available on request.

Stations were ranked according to the following factors:

A. One important factor was the magnitude of the average of the maximum and second highest 3- and 24-hour SO_2 concentrations recorded at each monitor. The station with the lowest and the station with the highest average SO_2 concentration in each of these factors during the 4-month period were assigned 0 and 15 points respectively, with other stations receiving weighted values in proportion to their average levels.

B. A factor considered of equal importance was the frequency that 3- and 24-hour average SO_2 concentrations were recorded in excess of a significant level. Base levels of 0.18 and 0.070 ppm respectively were established by taking the highest value exceeded by each station at least once during the study period. These values were used since they provided the largest "spread" of points from top station to bottom station. The station with the lowest average frequency was assigned 0 points, and the station with the highest average was assigned 15 points, with other stations receovomg weighted values in proportion to their average values.

C. Equally important was the measurement of exceedances of the 3- and 24-hour NAAQS during the 4-month period. The station that recorded the greatest number of exceedances was assigned 15 points with the remaining stations receiving weighted values in relation to the number of times they recorded these concentrations. Those stations where no excesses were recorded received zero points.

D. An additional factor was whether a monitor was located in or near (within 1 km) areas where SO_2-affected vegetation was observed during the study period. A station located in or near such areas the greatest number of times was assigned 15 points. Remaining stations received weighted values proportional to the number of times they were in or near these areas. Since there were no known adverse botanical effects during the evaluation period, (which did not include the growing season) all stations received zero points for this factor.

E. Lastly, the location of a station in a predominantly downwind sector from the power plant was also considered an important factor in determining monitor effectiveness. Although this factor is not directly associated with the time period and severity of SO_2 concentrations impacting a monitor, the probability of such an occurrence is enhanced. In rating this factor, monitors downwind the greatest percentage of time were assigned a maximum of 10 points, and those downwind the least percentage were assigned 0 points. Other monitors received weighted values proportional to their downwind percentages.

Discussions of Results

In determining the number and configuration of stations in the network for Shawnee Steam Plant, modeling was given considerable weight in the final selection because of the paucity of data representing the 244-m stack configuration.

Modeling

The modeling results are given in figure 6. Candidate areas indicating zones where elevated SO_2 concentrations may be expected to occur most often are shown for each of several selected conditions and averaging times. Two zones are identified as likely areas for monitoring elevated SO_2 under Class "A" stability conditions. Both areas lie between about 1.2 and 1.5 km from the steam plant. The range of expected concentrations associated with these two areas is 0.08 to about 0.11 ppm for a 3-hour average.

Separate areas are identified for 3-hour class "B" and "C/D" stability conditions. In both cases, these areas are in line with relatively frequent wind directions. The range of expected concentrations associated with the class "B" area is 0.04 to about 0.08 ppm. For the "C/D" areas the range of expected concentrations is about 0.03 to 0.04 ppm (3-hour average).

Two zones are identified in figure 6 as likely areas for monitoring elevated 24-hour-average concentrations. The range of expected concentrations in those two areas is 0.008 to about 0.01 ppm.

Ranking of Effectiveness

Existing air monitoring stations in the vicinity of the Shawnee Steam Plant were evaluated according to the five factors described in the "Methods" section. Weighted values were assigned each station in relation to the magnitude and frequency of SO_2 levels recorded, number of NAAQS excesses, proximity to areas of SO_2-affected vegetation, and downwind percentages as shown in figure 7 and table 1. Values assigned each monitoring station were totaled, and stations were ranked according to their resulting numerical value (table 2). Station 16 scored highest in the ranking scheme followed by stations 15, 13, 8, and 7. Since the steam plant operated for a brief 4-month period (December 6, 1977-May 15, 1978) on the new 244-m stacks only, these data were used to rank existing station effectiveness. However, there are problems with using a ranking scheme based upon data from this brief period.

The data appear not to be representative of long-term conditions because of a bias introduced by the seasonality of winds as shown in figure 7. The strong northwesterly component winds for this short period would have caused impacts from Joppa Steam Plant at a rate not representative of an entire year.

The most useful measure of effectiveness was an illustration (pollution rose) which correlated wind directions with various SO_2 levels (figure 8). The figure, while only representative of a limited time period, shows dramatically the influence of Joppa on TVA monitoring stations--particularly stations 15 and 16. This graphical representation allows a determination of the degree

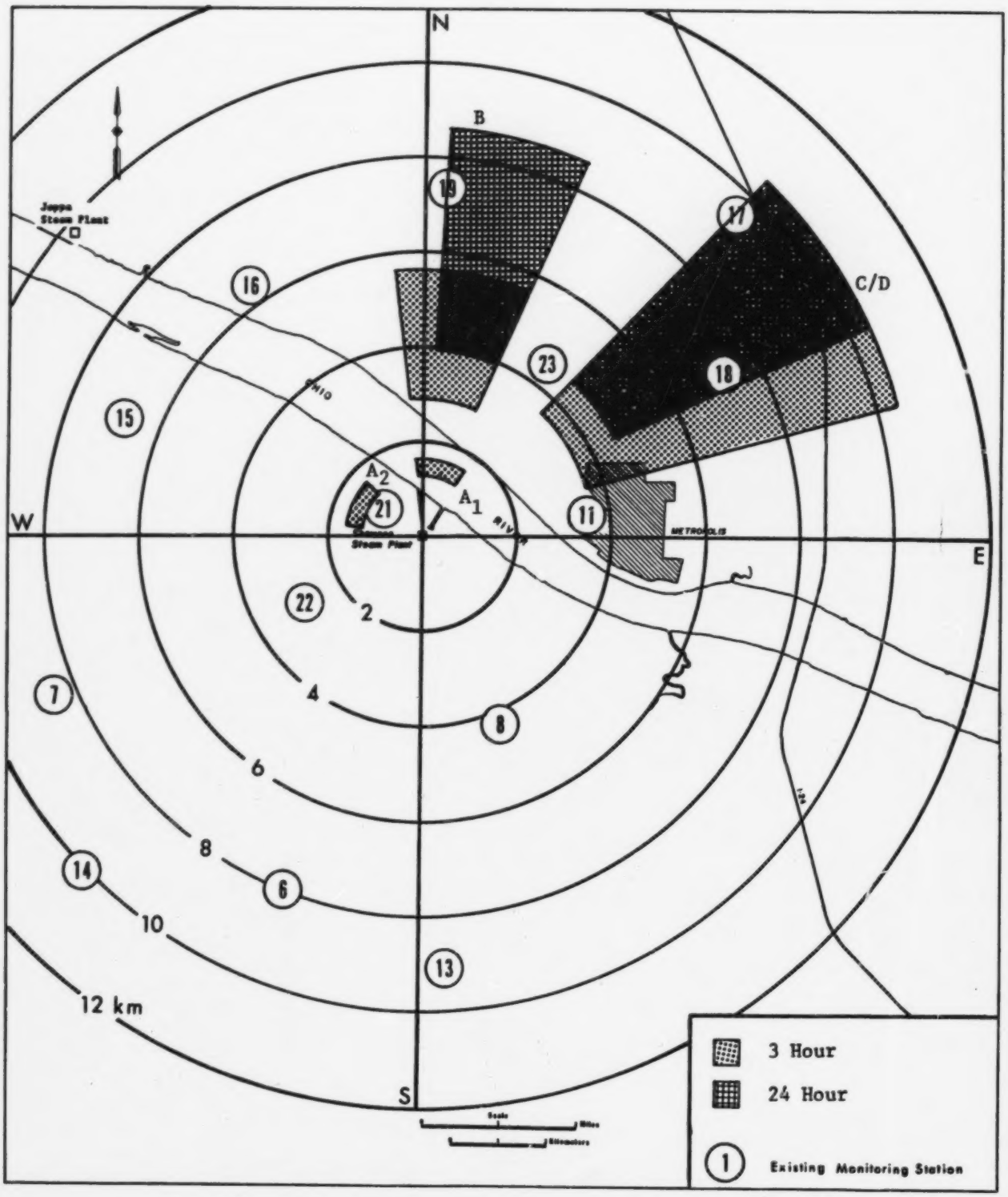

Figure 6. MODELED MAXIMUM 3- AND 24-HOUR SO_2 CONCENTRATION IMPACT POINTS IN THE VICINITY OF THE SHAWNEE STEAM PLANT

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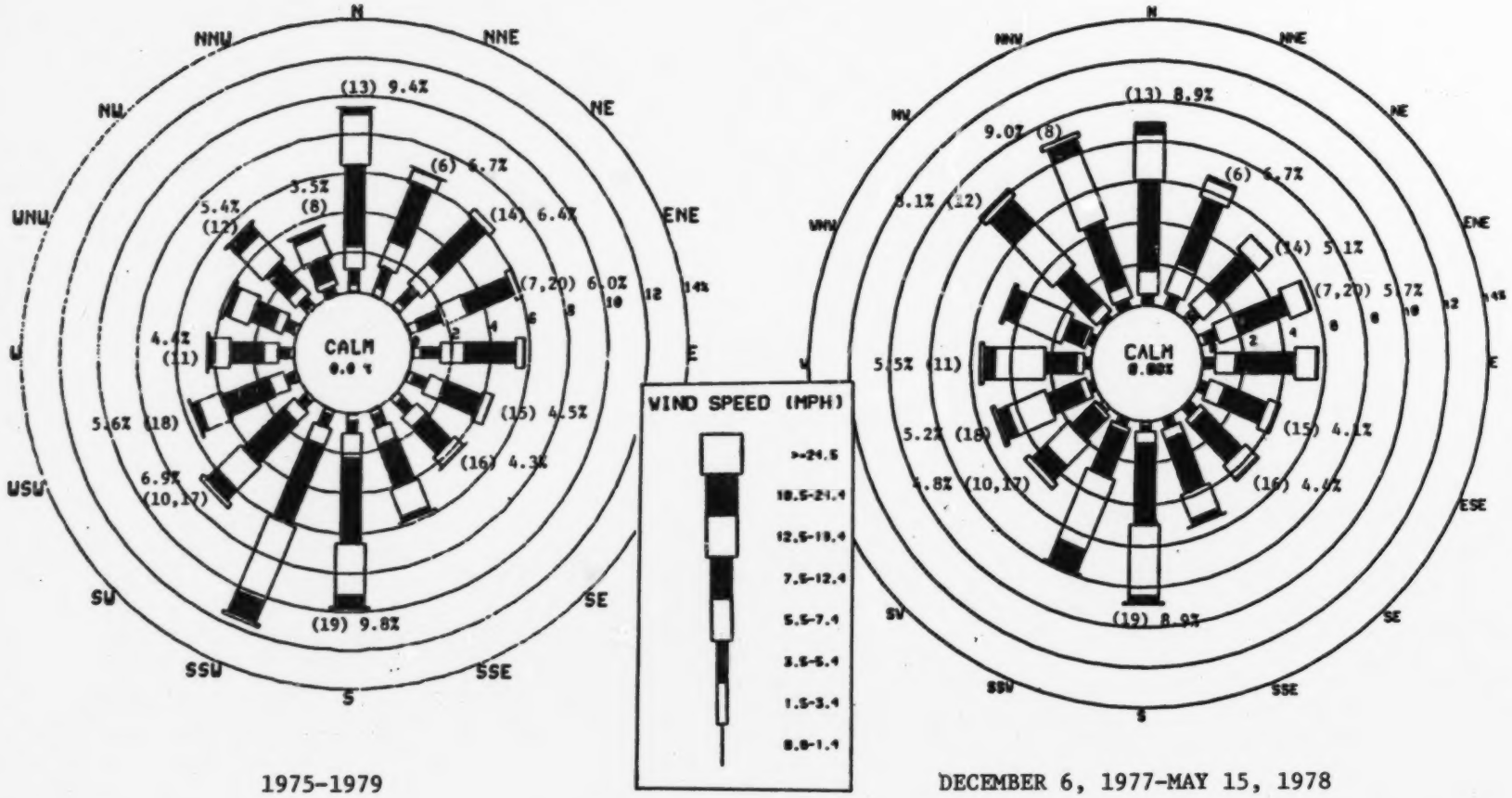

1975-1979

DECEMBER 6, 1977-MAY 15, 1978

Figure 7. THE PERCENTAGE OF TIME EXISTING MONITORS WERE DOWNWIND OF THE SHAWNEE STEAM PLANT

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Table 1

SO_2 MONITORING DATA - SHAWNEE STEAM PLANT
December 6, 1977 to May 15, 1978

	(A) Maximum and Second Highest 3- and 24-hour Average SO_2 Concentrations - PPM						(B) Frequency of 3- and 24-hour Average SO_2 Concentrations			(C) Number of 3- and 24-hour NAAQS Exceedances Recorded		
	3-hour			24-hour				3-hour	24-hour			
Station	Max	2nd	Average[a]	Max	2nd	Average[a]	Station	%>0.18 ppm	%>0.070 ppm	Station	3-hour	24-hour
6	.22	.20	.21	.07	.06	.07	6	.18	.18	6	0	0
7	.27	.20	.24	.09	.08	.09	7	.18	1.09	7	0	0
8	.41	.30	.36	.11	.07	.09	8	.21	.65	8	0	0
10	.29	.23	.26	.08	.06	.07	10	.10	.26	10	0	0
11	.22	.20	.21	.08	.07	.08	11	.13	.42	11	0	0
12	.34	.19	.27	.06	.06	.06	12	.10	.00	12	0	0
13	.32	.31	.32	.11	.08	.10	13	.29	1.12	13	0	0
14	.21	.19	.20	.06	.06	.06	14	.10	.00	14	0	0
15	.47	.39	.43	.11	.09	.10	15	.60	2.60	15	0	0
16	.33	.32	.33	.16	.10	.13	16	.94	2.35	16	0	1
17	.18	.16	.17	.07	.05	.06	17	.03	.05	17	0	0
18	.17	.16	.17	.08	.05	.07	18	.00	.18	18	0	0
19	.26	.25	.26	.07	.05	.06	19	.13	.05	19	0	0
20	.25	.18	.22	.08	.07	.08	20	.08	.62	20	0	0

a. Average of all values shown

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Table 2

RANKING OF THE EFFECTIVENESS OF AMBIENT AIR QUALITY MONITORING STATIONS IN THE VICINITY OF SHAWNEE STEAM PLANT

Factor	Maximum Weight	Monitoring Station Value*													
		6	7	8	23**	11	12	13	14	15	16	17	18	19	20
A. Monitor-Average 3-Hour Concentration	15	3	5	11	6	3	6	9	2	15	10	0	0	6	2
A. Monitor-Average 24-Hour Concentration	15	3	7	7	3	5	0	9	0	9	15	0	3	0	5
B. Monitor-Average 3-Hour Frequency	15	3	3	4	2	3	2	5	2	10	15	1	0	3	2
B. Monitor-Average 24-Hour Frequency	15	2	7	4	2	3	0	7	0	15	14	1	2	1	4
C. Excesses - NAAQS	15	0	0	0	0	0	0	0	0	0	15	0	0	0	0
D. Located in or near area of Botanical Impact	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Monitor-Downwind Sector	10	6	4	10	2	3	9	10	3	0	1	2	3	10	4
Total	100	17	26	36	15	17	17	40	7	49	70	4	8	20	17
Rank		7	5	4	8	7	7	3	10	2	1	11	9	6	7

*No data for stations 21 and 22 while on the 244-m stacks
**Formerly station 10

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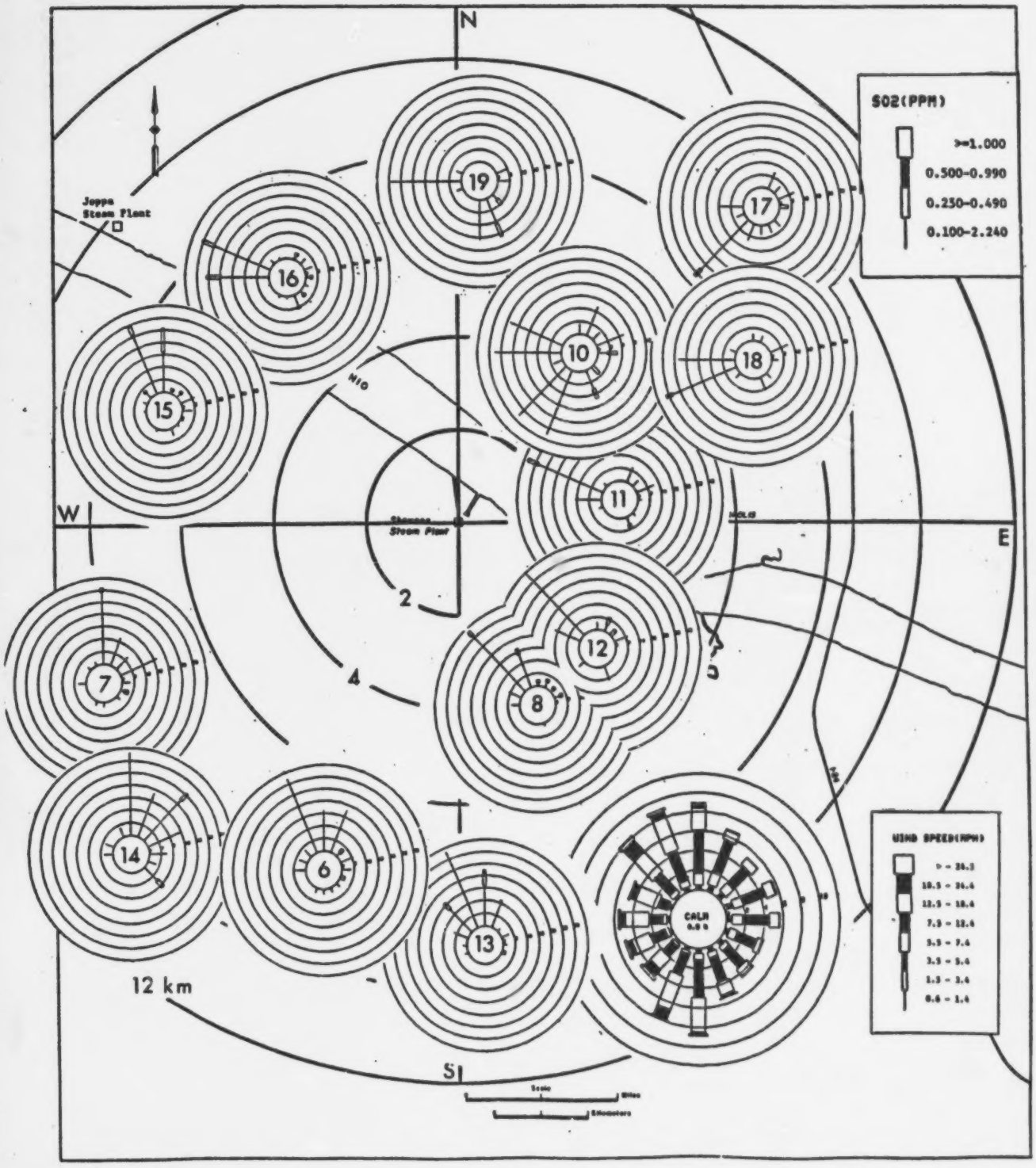

Figure 8. AIR POLLUTION ROSES, 244-METER STACK OPERATION - DECEMBER 6, 1977-MAY 15, 1978 - SHAWNEE STEAM PLANT

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(in a relative sense) to which stations were impacted by Shawnee emissions while on 244-m stacks. This can be accomplished by comparing the length and composition of bars pointing toward Shawnee Steam Plant. Additional analysis is contained in appendix B.

The figure shows that stations 8, 18, 13, 11, 12, and 17 received (in decreasing order) the highest impact from Shawnee Steam Plant. However, the graphic cannot distinguish between Joppa sources and Shawnee for stations 8, 11, and 12 because they are aligned such that they measure SO_2 from both plants in combination.

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Proposed Network

The network shown in figure 9 is proposed for immediate implementation. The network consists of five stations, four of which will be retained from the existing network and one new station.

Stations 18 and 21 were retained because they corresponded well with modeling results for predicted areas of maximum 3- and 24-hour SO_2 concentrations for stability classes "A" and "C/D." Station P-1 represents a relocation of station 19 to a site that is better suited for documenting predicted high 3- and 24-hour SO_2 concentrations for stability class "B." Existing stations 8 and 13 were retained because they demonstrated effectiveness in recording highest SO_2 concentrations (caused by Shawnee Steam Plant) with a relatively high degree of frequency during the 4-month period the plant operated on 244-m stacks.

The selection of monitors for the Shawnee monitoring plan involved a number of subjective decisions in order to fully satisfy current objectives and the diverse interests associated with ambient monitoring at Shawnee. Since the steam plant is located such that its emissions affect both Kentucky and Illinois, it is necessary that some degree of balance be maintained in the distribution of monitors to fulfill both States' needs. Table 3 summarizes the objectives fulfilled by the proposed network.

The proposed network shown in figure 9 consists of existing stations 8, 13, 18, 21, and the new site, P-1. Table 3 summarizes the objectives fulfilled by the proposed network. The decision to employ five stations for the recommended network at Shawnee has involved decisions about several subjective and practical factors.[4] While there is no substitute for "saturating" the plant's area of influence to obtain complete coverage, it is obvious for reasons of economy that such an approach is cost prohibitive. The monitoring plan recommended herein considers all relevant factors and should satisfy current objectives for ambient monitoring at Shawnee Steam Plant.[5]

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4. The proposal of a specific site is made contingent upon the availability of a suitable plot of land and the arrangement of lease rights for its use. Certain practical considerations (i.e., availability of power) may require some slight modifications to the recommended network.

5. Monitoring data from station 21 will be examined three years after the initiation of this proposed network. If this station is not impacted by the high SO_2 concentrations that were predicted under "A" stability, this station will be terminated.

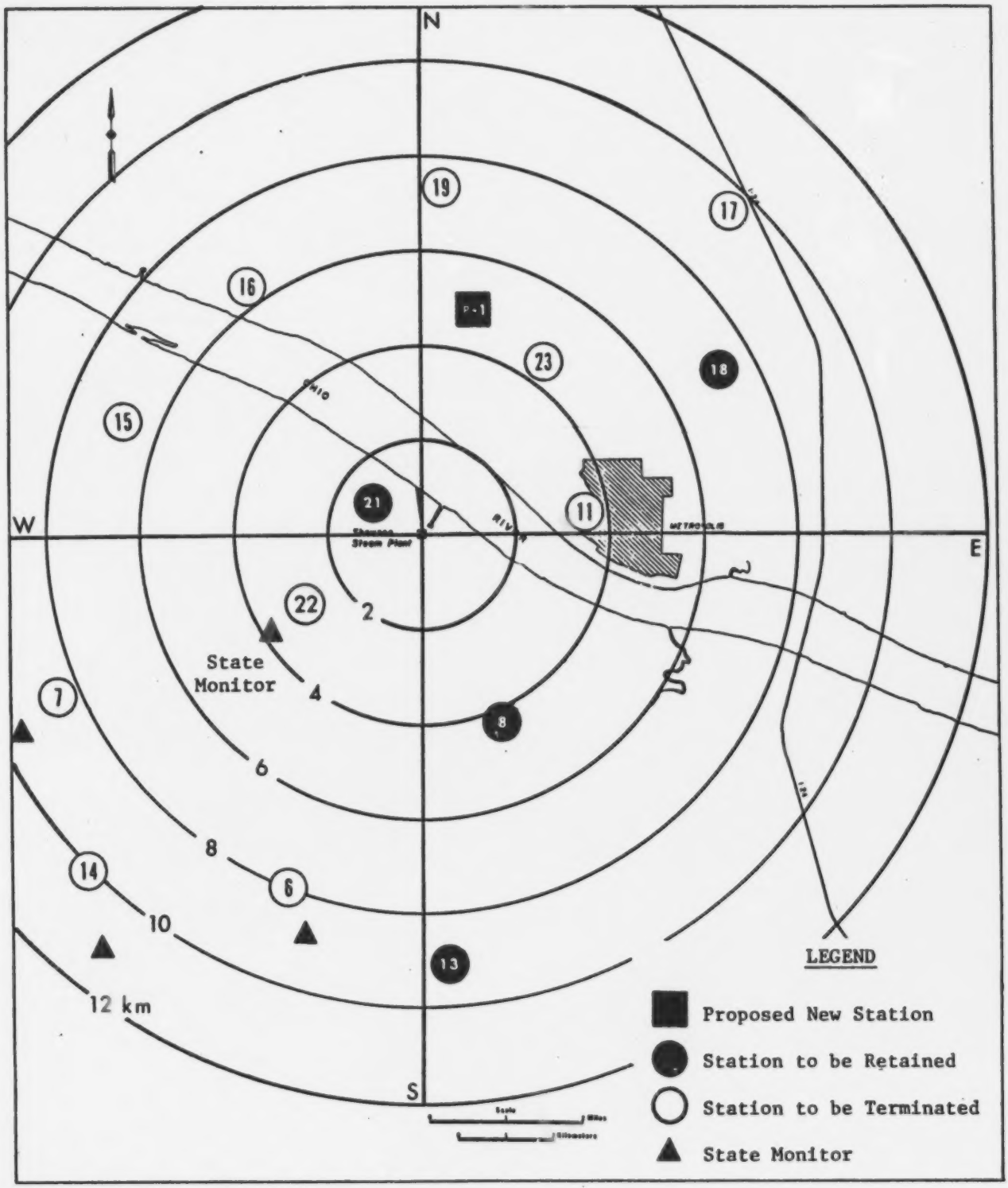

Figure 9. LOCATION OF STATIONS IN THE PROPOSED AMBIENT AIR QUALITY MONITORING NETWORK AT THE SHAWNEE STEAM PLANT

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Table 3

MONITORING OBJECTIVES ACHIEVED BY THE PROPOSED NETWORK

Station	Monitors	Distance (km)	Direction (°)	Monitor Objectives Achieved
P-1	SO_2 & TSP	5.0	011	Predicted area of high 3- and 24-hour SO_2 concentrations for stability class B, major downwind sector.
8	SO_2	4.2	157	High 3- and 24-hour SO_2 concentrations with high degree frequency, contribution from other sources.
13	SO_2	9.3	177	High 3- and 24-hour SO_2 concentrations, major downwind sector.
18	SO_2 & TSP	7.3	062	Predicted area of high 3- and 24-hour SO_2 concentrations for stability class C/D.
21	SO_2 & TSP	1.1	300	Predicted area of high 3-hour SO_2 concentrations for stability class A, PSD monitoring site for proposed AFBC demonstration plant.

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APPENDIX A

KENTUCKY AIR POLLUTION CONTROL REGULATIONS AND LETTERS FROM EPA APPROVING TVA SO_2 AND TSP MONITORING METHODS

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APPENDIX A

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL PROTECTION

DIVISION OF AIR POLLUTION CONTROL REGULATIONS

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DIVISION OF AIR POLLUTION CONTROL
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FRANKFORT, KENTUCKY 40601

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CHAPTER 53
AIR POLLUTION
AMBIENT AIR QUALITY

005. General provisions.
010. Ambient air quality standards.

401 KAR 53:005. General provisions.

RELATES TO: KRS Chapter 224
PURSUANT TO: KRS 13.082, 224.033
NECESSITY AND FUNCTION: KRS 224.033 requires the Department for Natural Resources and Environmental Protection to prescribe regulations for the prevention, abatement, and control of air pollution. This regulation is to provide for the establishment of general provisions, definitions and time schedules as they pertain to this chapter.

Section 1. Purpose and Intention. (1) The purpose of the primary ambient air quality standards is to define levels of air quality which the department judges are necessary, with an adequate margin of safety, to protect the public health. Secondary ambient air quality standards define levels of air quality which the department judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

(2) In the establishment of these standards, it is the intention of the department to prohibit further significant and avoidable deterioration of air quality in areas where air quality presently exists which is numerically equal to or less than the standards expressed herein.

(3) Except as provided in 401 KAR 51:010, no person shall violate, or interfere with the attainment or maintenance of, ambient air quality standards as specified in 401 KAR 53:010.

Section 2. Applicability. (1) The primary and secondary ambient air quality standards stated in 401 KAR 53:010 shall apply at any single point location.

(2) The secondary standard for odor shall be applicable only when the department receives a complaint with respect to odors from a source.

Section 3. Definitions. As used in this chapter, all terms not defined herein shall have the meaning given them in 401 KAR 50:010.

(1) "Ambient air" means that portion of the atmosphere, external to buildings, to which the general public has access.

(2) "Reference method" means a method of sampling and analyzing for an air pollutant as specified by Appendices A through G of 40 CFR 50, filed by reference in 401 KAR 50:015.

(3) "Equivalent method" means any method of sampling and analyzing of an air pollutant which can be demonstrated to the department's and the U. S. EPA's satisfaction to have a consistent relationship to the reference method.

(4) "Ambient air quality standard" means a numerical expression of a specified concentration level for a particular air contaminant and the time averaging interval over which that concentration level is measured and is a goal to be achieved in a stated time through the application of appropriate preventive and/or control measures.

(5) "Annual mean" means an average determined on the basis of any consecutive twelve (12) month interval.

(6) "Three (3) hour average" means an average determined on the basis of any consecutive three (3) hour interval.

(7) "Eight (8) hour average" means an average determined on the basis of any consecutive eight (8) hour interval.

(8) "Twelve (12) hour average" means an average determined on the basis of any consecutive twelve (12) hour interval.

(9) "One (1) week average" means an average determined on the basis of any consecutive seven (7) day interval.

(10) "Maximum" means an ambient air quality standard which shall not be exceeded more than once per year providing that the averages exceeding the standard do not contain any common hourly data points.

(11) "Odor" means the property of an air contaminant that can be detected by the sense of smell.

(12) "Standard condition" means a reference temperature of twenty-five (25) degrees Celsius and a reference pressure of 760 millimeters of mercury.

(13) "Year" means any consecutive twelve (12) month period. (5 Ky.R. 375; eff. 6-6-79.)

401 KAR 53:010. Ambient air quality standards.

RELATES TO: KRS Chapter 224
PURSUANT TO: KRS 13.082, 244.033
NECESSITY AND FUNCTION: KRS 224.033 requires the Department for Natural Resources and Environmental Protection to prescribe regulations for the prevention, abatement, and control of air pollution. This regulation is to fix ambient air quality standards necessary for the protection of the public health, the general welfare, and the property and people in this Commonwealth.

Section 1. Ambient Air Quality Standards. The primary and secondary ambient air quality standards for sulfur oxides, particulate matter, carbon monoxide, ozone, hydrocarbons, nitrogen dioxide, lead, hydrogen sulfide, gaseous fluorides, total fluorides, and odors are specified in Appendix A of this regulation. Measurements will be by methods specified in Section 2.

Section 2. Methods of Measurement. For those air contaminants for which there are state ambient air quality standards that are the same as the national ambient air quality standards, measurements shall be made according to reference methods, or their equivalent methods. For other air contaminants for which there are state ambient air quality standards, measurements shall be made according to methods as prescribed by the department. The frequency of measurements for all air contaminants shall be prescribed by the department.

Section 3. Within sixty (60) days of promulgation or revision of any ambient air quality standard by the U.S. EPA, the department shall initiate proceedings to promulgate or review this regulation in conformance with the federal ambient air quality standards. (5 Ky.R. 376; Am. 997; eff. 6-6-79.)

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(4) Methods like those outlined in the "Workbook for the Comparison of Air Quality Models" (U. S. EPA, Office of Air Quality Planning and Standards) shall be used to determine the comparability of air quality models. (5 Ky.R. 359; Am. 981; eff. 6-6-79.)

401 KAR 50:045. Performance tests.

RELATES TO: KRS Chapter 224
PURSUANT TO: KRS 13.082, 224.033
NECESSITY AND FUNCTION: KRS 224.033 requires the Department for Natural Resources and Environmental Protection to prescribe regulations for the prevention, abatement, and control of air pollution. This regulation establishes requirements for performance tests.

Section 1. The department may require the owner or operator of any affected facility to sample emissions in accordance with such methods as the department shall prescribe. All tests shall be made under the direction of persons qualified by training and/or experience in the field of air pollution control.

Section 2. The department may conduct tests of emissions of air contaminants from any source.

Section 3. Test methods and Exceptions. (1) Performance tests required hereunder or by any other regulation of the Division of Air Pollution for affected facilities which are subject to a standard of performance promulgated under 40 CFR 60 or 40 CFR 61, filed by reference in 401 KAR 50:015, shall be conducted, and data shall be reduced, in accordance with the reference methods and procedures contained in each applicable regulation unless:

(a) The department specifies or approves the use of a reference method with minor changes in methodology;

(b) The department and the U. S. EPA approve the use of an equivalent method;

(c) The department and the U. S. EPA approve the use of an alternative method the results of which it has determined to be adequate for indicating whether a specific source is in compliance; or

(d) The department and the U. S. EPA waive the requirement for performance test for affected facilities for which a standard of performance has been promulgated under 40 CFR 60 or 40 CFR 61 because the owner or operator of such affected facility has demonstrated to the department's and the U. S. EPA's satisfaction that the affected facility is in compliance with the applicable standard.

(2) Performance tests required hereunder or by any other regulation of the Division of Air Pollution for affected facilities which are not subject to a standard of performance promulgated under 40 CFR 60 or 40 CFR 61 shall be conducted, and data shall be reduced, in accordance with the methods and procedures contained in each applicable regulation unless:

(a) The department specifies or approves minor changes in methodology;

(b) The department specifies or approves the use of some other method the results of which it has determined to be adequate for indicating whether a specific source is in compliance; or

(c) The department waives the requirement for performance tests because the owner or operator of the affected facility has demonstrated to the department's satisfaction that:

1. The affected facility is in compliance with the applicable standard; or
2. In the case of an existing affected facility, the test cannot be performed by a source due to physical plant limitations or extreme economic burden. The burden of proof for an alleged "economic burden" is to be borne by the source.

Section 4. The owner or operator shall permit the department to conduct performance tests at any reasonable time, shall cause the affected facility to be operated for purposes of such tests under such conditions as the department may specify based on representative performance of the affected facility, and shall make available to the department such records as may be necessary to determine such performance.

Section 5. The owner or operator of an affected facility shall provide the department ten (10) working days prior notice of the performance test to afford the department the opportunity to have an observer present.

Section 6. The owner or operator of an affected facility shall provide, or cause to be provided, performance testing facilities as follows:

(1) Sampling ports adequate for test methods applicable to such facility.
(2) Safe sampling platform(s).
(3) Safe access to sampling platforms(s).
(4) Utilities for sampling and testing equipment.

Section 7. Each performance test shall consist of three (3) separate runs using the applicable test method. Each run shall be conducted for such time and under such conditions specified in the applicable regulation. For the purpose of determining compliance with an applicable standard, the arithmetic mean of the results of the three (3) runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one (1) of the three (3) runs must be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the owner or operator's control, compliance may, upon the department's approval, be determined using the arithmetic mean of the results of the two (2) other runs. (5 Ky.R. 360; eff. 6-6-79.)

401 KAR 50:050. Monitoring.

RELATES TO: KRS Chapter 224
PURSUANT TO: KRS 13.082, 224.033
NECESSITY AND FUNCTION: KRS 224.033 requires the Department for Natural Resources and Environmental Protection to prescribe regulations for the prevention, abatement, and control of air pollution. This regulation establishes requirements for stack gas monitoring, ambient air monitoring, and recording and reporting requirements as related to monitoring data.

Section 1. Monitoring, Records, and Reporting. The department may require the owner or operator of any af-

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fected facility to install, use, and maintain stack gas and ambient air monitoring equipment in accordance with such methods as the department shall prescribe, establish and maintain records of same and make periodic emission reports at intervals prescribed by the department. Requirements for specific affected facilities are contained in applicable regulations.

Section 2. Ambient Air Monitoring. Persons owning or operating any affected facility for which a standard is prescribed in the regulations of the Division of Air Pollution when required by the department shall install, use, and maintain ambient air monitoring equipment in accordance with the provisions of 401 KAR 53:010, Section 2, and shall make periodic ambient air monitoring reports at intervals prescribed by the department. (5 Ky.R. 360; eff. 6-6-79.)

401 KAR 50:055. General compliance requirements.

RELATES TO: KRS Chapter 224
PURSUANT TO: KRS 13.082, 224.033
NECESSITY AND FUNCTION: KRS 224.033 requires the Department for Natural Resources and Environmental Protection to prescribe regulations for the prevention, abatement, and control of air pollution. This regulation establishes requirements for compliance during shutdown and malfunctions; establishes requirements for demonstrating compliance with standards; establishes requirements for compliance when a source is relocated within the Commonwealth of Kentucky; and other general compliance requirements.

Section 1. Emissions During Shutdown and Malfunction. (1) Emissions which, due to shutdown or malfunctions, temporarily exceed the standard set forth by the department shall be deemed in violation of such standards unless the requirements of this section are satisfied and the determinations specified in subsection (4) of this section are made.

(2) When emissions during any planned shutdown and ensuing startup will exceed the standards, the owner or operator of the source shall notify the director or his designee no later than three (3) days before the planned shutdown. However, if the shutdown is necessitated by events which the owner or operator could not reasonably have foreseen three (3) days before the shutdown, then such notification shall be given immediately following the decision to shutdown. The notice shall be in writing and shall specify the name of the air contaminant source, its location, the address and telephone number of the person responsible for the source, the reasons for and duration of the proposed shutdown, the date and time for the action, the physical and chemical composition, rate and concentration of the emissions during such shutdown and ensuing startup, the basis for determination that such shutdown is necessary, and the measures which will be taken to minimize the extent and duration of the emissions during such shutdown and ensuing startup.

(3) When emissions due to malfunctions, unplanned shutdowns or ensuing startups are or may be in excess of the standards, the owner or operator shall notify the director by telephone as promptly as possible, and shall cause written notice when requested by the director to be sent to the director. Such notice shall specify the name of the source, its location, the address and telephone number of the person responsible for the source, the nature and cause of the malfunctions, or unplanned shutdown, the date and time when the malfunction was first observed, the expected duration, the nature of the action to be taken to correct the malfunction, and an estimate of the physical and chemical composition, rate and concentration of the emission.

(4) A source shall be relieved from compliance with the standards set forth by the department if the director determines, upon a showing by the owner or operator of the source, that:

(a) The malfunction or shutdown and ensuing startup did not result from the failure by the owner or operator of the source to operate and maintain properly the equipment;

(b) All reasonable steps were taken to correct, as expeditiously as practicable, the conditions causing the emissions to exceed the standards, including the use of off-shift labor and overtime if necessary;

(c) All reasonable steps were taken to minimize the emissions and their effect on air quality resulting from the occurrence;

(d) The excess emissions are not part of a recurring pattern indicative of inadequate design, operation, or maintenance; and

(e) The malfunction or shutdown and ensuing startup was not caused entirely or in part by poor maintenance, careless operation or any other preventable upset conditions or equipment breakdown.

(5) The director shall notify the owner or operator of the source of the determination made under this section no later than sixty (60) days after the date that all information required by this section has been submitted.

Section 2. Compliance with Standards and Maintenance Requirements. (1) An owner or operator of any affected facility subject to any standard within the regulations of the Division of Air Pollution shall:

(a) In the case of a new source, demonstrate compliance with the applicable standard(s) within sixty (60) days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of such facility;

(b) In the case of an existing source, demonstrate compliance with the applicable standard before or on the date that final compliance is required by the applicable compliance schedule unless otherwise specified by regulation; and

(c) Maintain the affected facility in compliance with all applicable standards at all times subsequent to the date that compliance is demonstrated.

(2) Compliance with standards in the regulations of the Divison of Air Pollution shall be demonstrated as follows:

(a) By performance tests as specified in the applicable regulation and according to the requirements and exceptions provided in 401 KAR 50:045.

(b) By methods other than performance tests as provided for by the applicable regulation.

(c) By methods acceptable to the department if the applicable regulation does not specify a performance test or other method of determining compliance.

(3) Compliance with opacity standards in the regulations of the Division of Air Pollution shall be determined by Method 9 of Appendix A of 40 CFR 60, filed by reference in 401 KAR 50:015, except as may be provided for by

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27711

November 8, 1979

John P. Blackwell
Chief, Air Quality Branch
Tennessee Valley Authority
River Oaks Building
Muscle Shoals, AL 35660

RE: Request for approval to operate designated SO_2 analyzers on nonconforming ranges.

Dear Mr. Blackwell:

This is in response to your October 8, 1979 request for approval to operate approximately 105 designated Philips PW 9700 SO_2 analyzers on ranges of 0-1, 0-2 and 0-5 ppm at various indentified sites in the TVA area.

We note your understanding that your monitoring is not subject to the SLAMS regulations, and we respect your desire to voluntarily comply with those regulations.

Request for 0-1 ppm range approval:

This letter shall constitute approval under section 2.5 of 40 CFR Part 58, Appendix C for your agency to operate any of the Philips PW 9700 SO_2 analyzers identified in your request on a range of 0-1 ppm.

Request for 0-2 ppm range approval:

Use of the 0-2 ppm range for those analyzers so identified in your submitted schedule is hereby approved under section 2.6.2 of 40 CFR Part 58, Appendix C subject to the following conditions:

1. that the resolution (smallest change in concentration that can be measured) is adequate for the intended objective of the monitoring and particularly if the measurements will be used in long-term averages to compare with the .03 ppm annual arithmetic mean primary standard;

2. that the analyzers will be used on the 2 ppm range only in the geographical area specified in the request for approval;

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3. that the conditions leading to SO_2 concentrations or the likelihood of concentrations over 1 ppm continue to exist in the specified geographical area; and

4. that the data quality control and quality assessment procedures required by Appendix A of 40 CFR Part 58 or other applicable quality assurance requirements are appropriately adapted to the 2 ppm range.

Please notify this office within 30 days of any change in the above conditions which might affect this approval.

Request for 0-5 ppm range approval:

In regard to operation on a 0-5 ppm range, we are highly concerned about the effective resolution of the overall measurement system, including the analyzers as well as the measurement recording device. The attached letter to the Arizona Department of Health Services describes our concerns more detail and specifies the conditions under which we will consider approval. We also must consider the fact that changing range on the Philips PW9700 analyzer affects the chemical equilibrium of the measurement cell and may thus affect analyzer performance.

In view of these circumstances, we cannot approve any analyzer on a 0-5 ppm range until we have more information about the operation of the specific analyzers proposed for 0-5 ppm operation. Therefore, under section 2.7.5 of 40 CFR Part 58, Appendix C, we request additional information in the following areas:

1. The specific use or limits that will be put on the use of the measurements obtained with analyzers operating on the 0-5 ppm range;

2. The effect of the 0-5 ppm range on the performance of the Philips PW9700 SO_2 analyzer compared with its performance on the 0-0.5 ppm or 0-1 ppm range;

3. The type of data recording device or system that will be used and rationale supporting the adequacy of the overall resolution of the measurement system with respect to item 1; and

4. The nature and extent of quality assurance procedures that would be used with the 0-5 ppm range.

Department E will be available to discuss this determination or any of the issues with you further if you desire.

Sincerely yours,

Larry J. Purdue
Department E (MD-77)
Methods Standardization Branch
Quality Assurance Division

11/13/79--RVC:HH
mc: C. H. Smith, 350 EB-K
N. T. Lee, 124F ROB-M
A. E. Owen, 124D ROB-M

cc: Doyle T. Brittain,
EPA, Region IV

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27711

April 10, 1980

Mr. John P. Blackwell
Chief, Air Quality Branch
Tennessee Valley Authority
River Oaks Building (Room 100A)
Muscle Shoals, Alabama 35660

Dear Mr. Blackwell:

Your proposed modifications to the Federal reference method for measuring total suspended particulates in the atmosphere, consisting of (1) replacing the rotameter with an orifice plate and differential pressure gage as the flow rate measuring device, and (2) modifying the calibration method to use a precision flow orifice calibrated by water flow as the flow standard, as detailed in your request dated March 19, 1980, is hereby approved. No special approval is necessary for the use of constant flow controllers.

Sincerely yours,

Larry J. Purdue
Methods Standardization Branch
Quality Assurance Division

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APPENDIX B

AIR POLLUTION ROSE DATA
SHAWNEE STEAM PLANT
1975-1979

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Appendix B

Air Pollution Rose Data - Shawnee Steam Plant

1975-1979

In order to confirm the extent to which other sources were contributing to SO_2 concentrations recorded at monitoring stations in the vicinity of Shawnee Steam Plant, pollution roses were constructed for various plant configurations. A pollution rose is a graphical representation of the frequency that various combinations of wind direction and pollutant trends occur. These roses represent operation of the plant with short stacks only, short and tall stacks, tall stacks only, and short stacks, in the chronological order that there were utilized at Shawnee during the period 1975-1979.

Unfortunately the pollution analysis is complicated because of changing sulfur dioxide emissions from the Shawnee Steam Plant. As shown in figure 2, SO_2 emissions dropped from about 720 tons per day, while operating on 244-m stacks in 1976, to less than 400 tons per day during late 1979. In spite of the masking effects of changing emission rates, it is possible to derive some useful information with which to decide on the effectiveness of various stations for monitoring 244-m stack emissions.

The following may be concluded from an examination of the pollution roses shown in figures B-1 through B-4.

1. When taller stacks were brought on line beginning about December 6, 1977, the impact of emissions from Shawnee diminished, whereas, the influence from Joppa Steam Plant appeared to remain constant. However, since SO_2 emissions also decreased during this period, the reduced impact from Shawnee reflected the result of both factors.

2. During the use of tall stacks only, the influence from Shawnee is reduced dramatically, however part of this is due to lower SO_2 emissions. Unfortunately, this observation must be qualified since it represents only a short period of plant operation, primarily during the winter and early spring of 1978 when winds were predominantly from the north to northwest sector.

3. The reversion to short stacks about September 1978 was accompanied by a noticable increase in the measurement of SO_2 emitted from Shawnee, even though average SO_2 emissions generally decreased for this period.

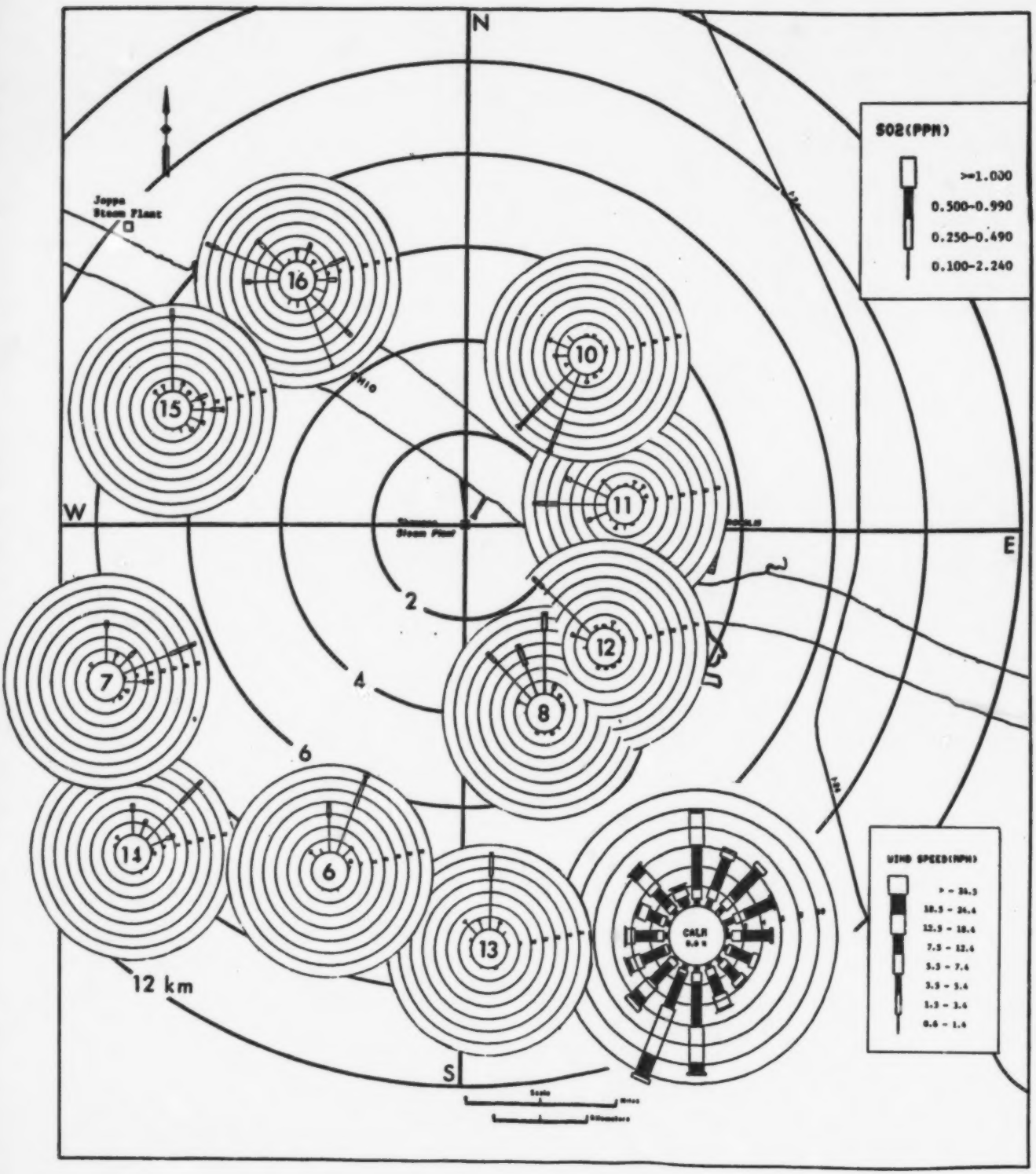

Figure B-1. AIR POLLUTION ROSES, 76-METER STACK OPERATION - DECEMBER 23, 1975-DECEMBER 23, 1976 - SHAWNEE STEAM PLANT

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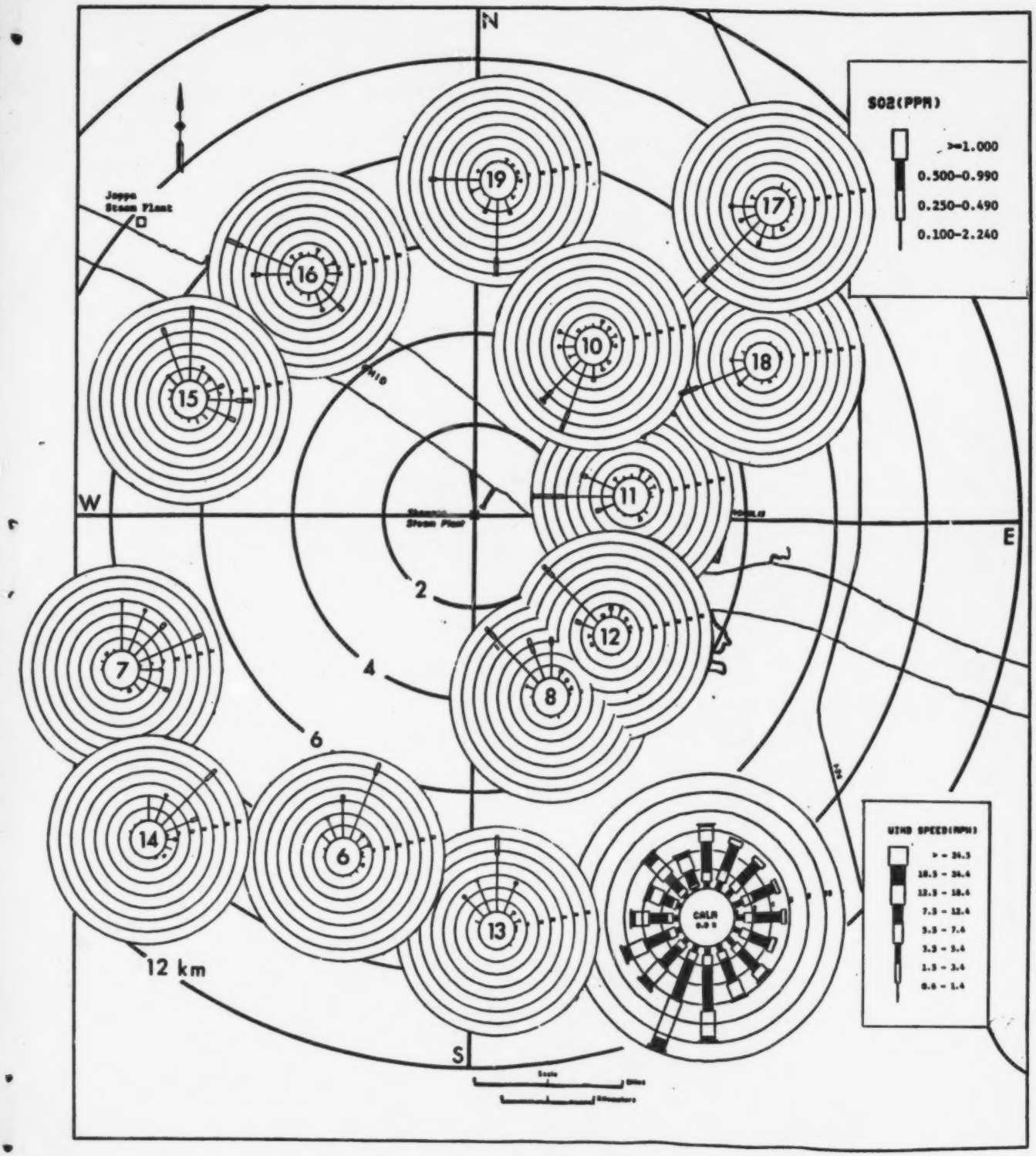

Figure B-2. AIR POLLUTION ROSES, 76-METER AND 244-METER STACK OPERATIONS - DECEMBER 23, 1976-SEPTEMBER 20, 1978 - SHAWNEE STEAM PLANT

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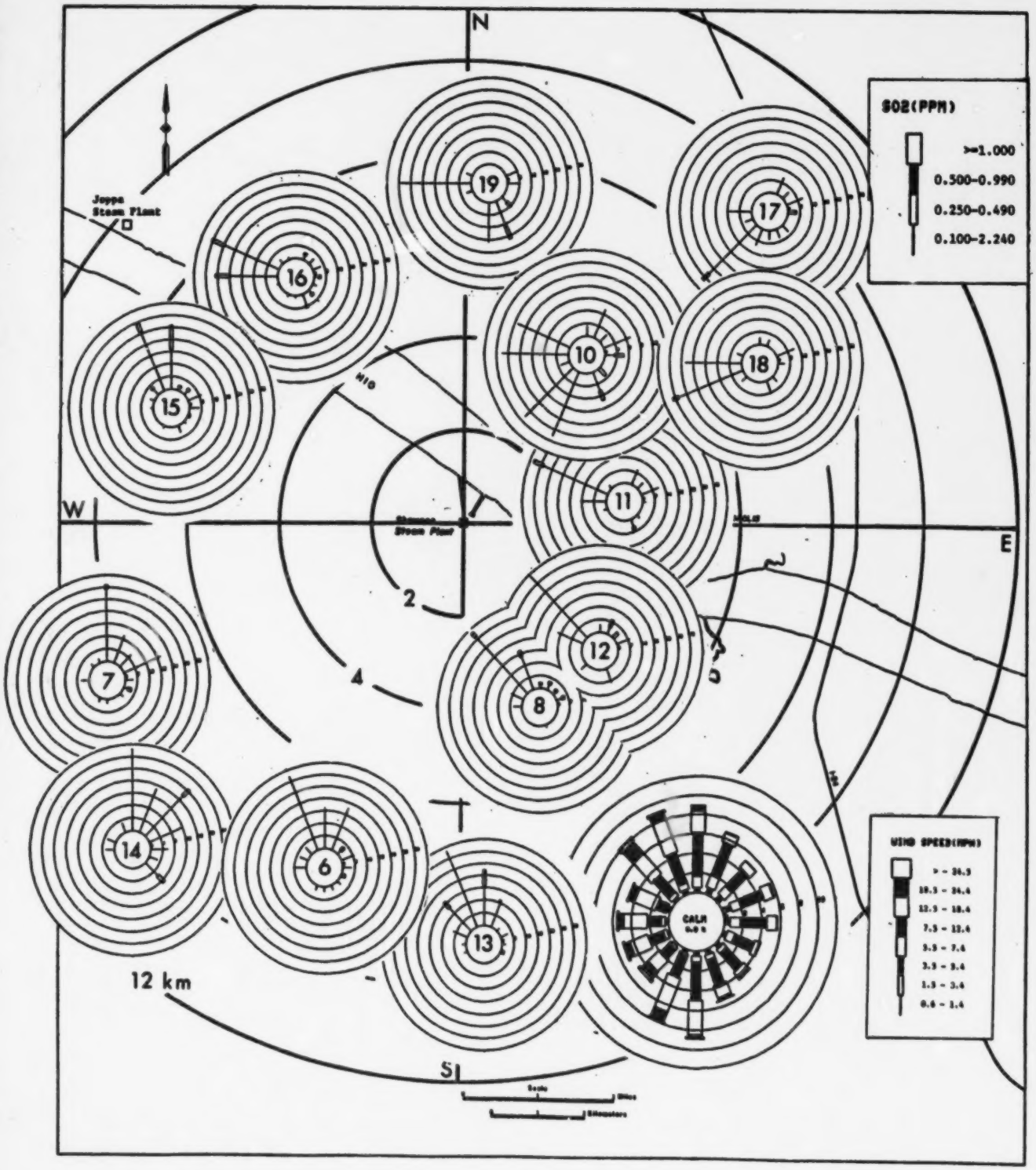

Figure B-3. AIR POLLUTION ROSES, 244-METER STACK OPERATION - DECEMBER 6, 1977-MAY 15, 1978 - SHAWNEE STEAM PLANT

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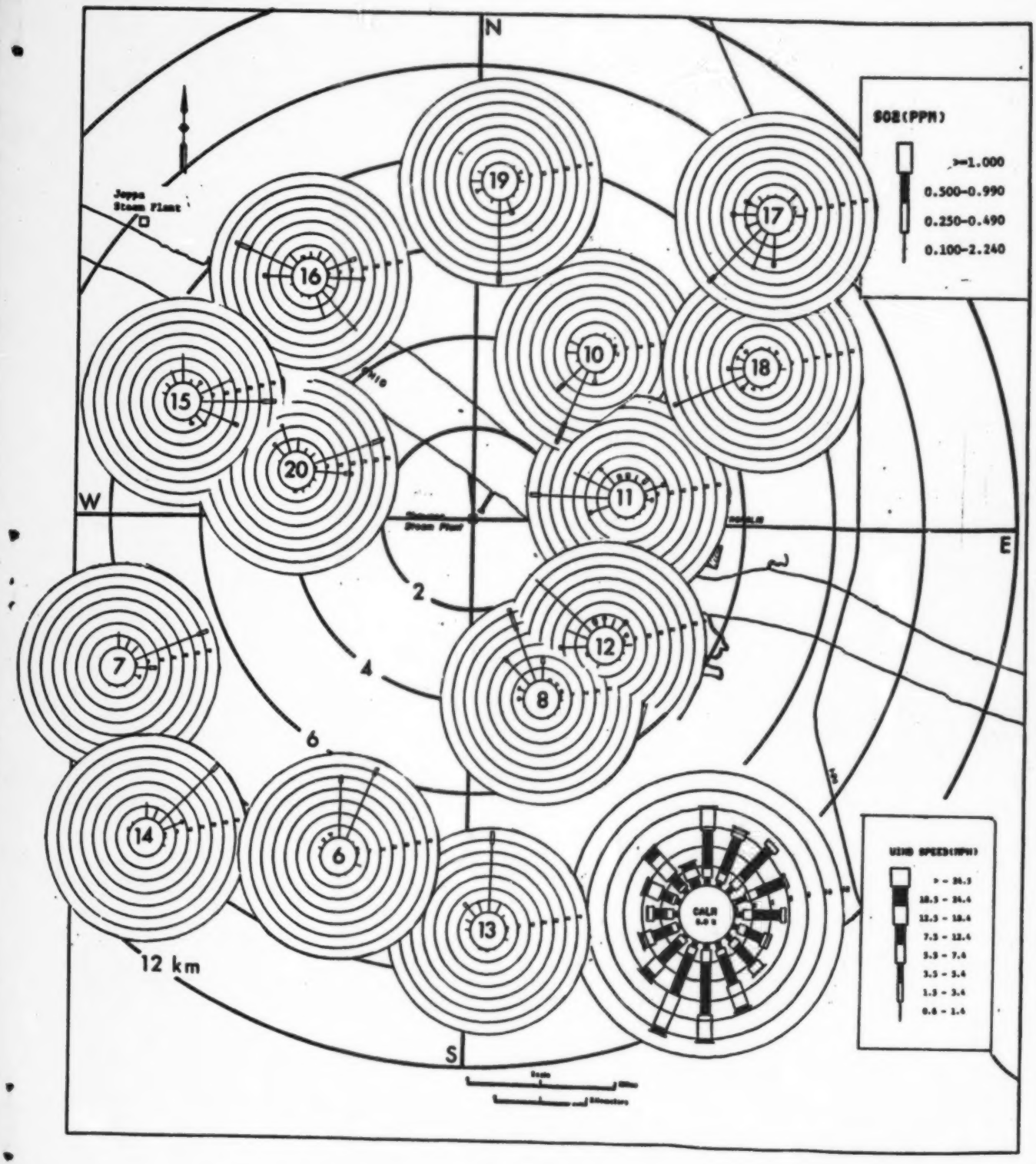

Figure B-4. AIR POLLUTION ROSES, 76-METER STACK OPERATION - SEPTEMBER 20, 1978-SEPTEMBER 20, 1979 - SHAWNEE STEAM PLANT

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